

REMARKS

Claims 1, 3-14, 16-19, 21-26, 28-37, and 39-46 remaining pending in the application. Applicants have amended claims 1, 11, 19, 31, and 39 to recite a system or method wherein the blood vessel is analyzed as if it was standing still without post processing selection of desired blood-vessel data. Support for these amendments can be found, for example, in paragraph [0009] of Applicants' published application.

Summary of the Office Action:

Claims 1, 3, 5-9, 11-14, 16-19, 21-29, 31-35, 37, 39, 40, and 42-46 are rejected under 35 U.S.C. § 103 as obvious over U.S. Patent No. 6,148,095 ("Prause") in view of U.S. Patent No. 5,771,895 ("Slager"); Claims 4 and 41 are rejected under § 103 as obvious over Prause, Slager and further in view of U.S. Patent No. 6,200,268 ("Vince"); and claims 10, 30, and 36 are rejected under § 103 as obvious over Prause, Slager and further in view of U.S. Patent No. 5,284,148 ("Dias"). No claims presently stand allowed.

Discussion of the Rejections under 35 U.S.C. § 103

Applicants traverse the rejection of independent claims 1, 11, 19, 31, 39 and their corresponding dependent claims for the reasons discussed in Applicants' prior Replies to Office Action and further for the reasons set forth herein in view of the amended claims.

Claim 1 recites a system with a "data gathering device" that is adapted to "acquire said heartbeat data; identify a cyclical portion of said heartbeat data; and acquire said blood-vessel data during an interval substantially corresponding to said cyclical portion of said heartbeat data...during the interval in response to a probe-trigger marking a beginning of the cyclical portion." Amended claim 1 further recites that the data-gathering device permits "analysis of the blood vessel as if the blood vessel was standing still without post processing selection of desired blood-vessel data."

As described in Applicants' specification, the claimed system allows analysis (e.g. imaging) of the blood vessel as if it were standing still by collecting data during a cyclical portion of the heartbeat cycle when the vessel is in the same relative position as it expands and/or contracts. Moreover, the claimed system allows selective acquisition of the vessel data of interest on the fly thereby avoiding time consuming post processing associated with prior art systems.

The Prause patent, upon which the rejection of the claims relies, discloses a system wherein data is continuously received and stored by the system. Afterward, during a data

processing stage that is independent of the data acquisition stage, a processor selects certain of the previously recorded VHS image frames based upon a heart cycle signal. Thus, Prause is able to select frames of interest, but requires considerably greater computation and memory resource expense than the claimed invention wherein a “trigger” selectively enables image data acquisition of “blood-vessel data during an interval substantially corresponding to said cyclical portion of said heartbeat data.” Indeed, the type of system disclosed in Prause, and its disadvantages, are described in the Background section of Applicants’ specification. See specification at ¶ [0008] to [0009]. Moreover, Prause expressly requires post processing to select the desired images. In contrast, amended claim 1 requires that the system “permit analysis of the blood vessel as if the blood vessel was standing still without post processing selection of desired blood-vessel data.”

Slager is primarily directed to post acquisition reconstruction of a 3-D path of a catheter axis. See e.g., Slager Abstract, col. 4, lines 60-col. 5 line 25; col. 6, lines 14-35; col. 8, line 39-47. In a post processing stage, IVUS images are wrapped around this axis to reconstruct a 3-D image of the vasculature. Applicants respectfully disagree with the Office Action’s conclusion that Slager discloses selective triggered image acquisition as claimed for the reasons set forth in Applicants’ prior Reply to Office Action dated October 14, 2008. Moreover, as set forth above, amended claim 1 requires a system that permits analysis of the blood vessel as if it were standing still without post processing selection of desired blood-vessel data. In contrast, Slager expressly describes that post processing is required:

The IVUS images are recorded during automated pull-back on a PAL standard S-VHS video tape, resulting in 25 images/second ...

Following the acquisition, the S-VHS images are semiautomatically processed ... to detect the contour of both the lumen and the external elastic membrane. **Only images containing the R-peak marker are selected**, thus restricting analysis to the end-diastolic shape of the artery. The X, Y positions of the detected points are transferred to a file, together with the R--R interval. The time at which each image was recorded is interpreted as Z-axis value, making use of the fact that the intravascular ultrasound catheter moved at constant speed through the artery.

Using MATLAB, a numeric computation and visualization program, **the collected points are resampled** at a constant Z-axis interval of 1 second, which translates into 1 millimeter distances between successive cross-sectional images. The contour data are subsequently converted to cylindrical coordinates, thus expressing the vessel wall, as well as the external elastic membrane by $r = \text{function}(\phi, z)$, where r =radius; ϕ =angle, and z =position along Z-axis. Next, a smoothing algorithm is applied to the surface $\text{function}(\phi, z)$ by removing the higher frequency components of its 2D

Fourier transform. *The final result is a stack of IVUS cross-sectional images (FIG. 5), all aligned perpendicular to and centered around the Z-axis.*

(Slager, Col. 12, lines 8-53).

Thus, neither Prause nor Slager disclose, teach or suggest a system that permits “analysis of the blood vessel as if the blood vessel was standing still without post processing selection of desired blood-vessel data.” For at least this reason, claim 1 and its dependent claims are patentable over Prause and Slager even when the teachings of those references are combined.


Remaining independent claims 11, 19, 31 and 39 were each likewise amended to recite a system or method that permits analysis of a blood vessel as if standing still without post processing selection of data. Thus, the remaining independent claims and their dependent claims are patentable for the same reasons as claim 1.

The Office Action also rejects claims 4 and 41 as obvious over Prause in view of Slager and further in view of Vince and dependent claims 10, 30, and 36 as obvious over Prause in view of Slager and further in view of Dias. Each of these rejections is predicated on Prause and Slager teaching each of the limitations set forth in the corresponding independent claim. As set forth above, the independent claims are patentable over the combination of Prause and Slager. For the same reasons, claims 4, 10, 30, 36 and 41 are patentable as well.

Conclusion

Applicants respectfully submit that the patent application is in condition for allowance. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,


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